



REMARKS

Applicant has carefully reviewed and considered the Office Action mailed on March 28, 2001, and the references cited therewith.

New claims 68-75 are added, which are supported by the specification, claims and drawings as filed. No new matter is introduced thereby. Claims 1-24 and 64-75 are pending in this application.

§103 Rejection of the Claims

Claims 1-24 and 64-67 were rejected under 35 USC § 103(a) as being unpatentable over Cook et al. (U.S. 5,457,345) in view of Thomas (U.S. 4,661,375) and Strube et al. (U.S. 4,650,548).

The Office Action states at paragraph 2 regarding claims 1-24 and 64-67, that Cook et al. disclose "forming a metal contact pad on a substrate (12, fig. 1); forming an insulating layer on the metal contact pad (14, fig. 1); removing a portion of the insulating layer to expose a portion of the metal contact pad, thereby forming an exposed portion of the metal contact pad; depositing solder (46, fig. 4), wherein at least one material is selected from the group consisting of lead, tin, bismuth, on the exposed portion of the metal contact pad (44, fig. 4) using selective deposition, further comprises depositing solder on the exposed portion of the metal contact pad using a deposition process selected from the group consisting of immersion contact, chemical vapor deposition and electrolytic deposition, thereby forming a solder contact (col. 5, lns. 1-10 and 37-49); and annealing the solder contact to form a ball contact having a diameter in the range of about 2.5 microns to no greater than 100 microns (col. 2, lines 1-5).

Applicant respectfully notes that Applicant cannot find in Cook et al. a teaching or suggestion of a method of forming a solder ball contact including forming an exposed portion of a metal contact pad having a specific or predetermined diameter. Applicant also notes that it cannot find this element in the cited combination. Applicant notes that the "Response to Arguments" section at paragraph 1 of the Final Office Action mailed September 26, 2000, also states that Cook does not show a metal contact having a predetermined diameter.

Applicant further notes that the methods set forth in claims 1-8, 9-10, 12, 13-14, 16-22 and 64-67 include the limitation of annealing a solder contact to form a solder ball contact having a diameter in the range of about 2.5 microns to no greater than 100 microns. Applicant cannot find in Cook et al., Strube et al., Thomas, or the combination thereof, such a method.

Applicant cannot find in Cook et al. a teaching or suggestion of depositing solder on an exposed portion of a metal contact pad using a deposition process selected from the group consisting of immersion contact, chemical vapor deposition and electrolytic deposition, thereby forming a solder contact. Applicant further cannot find this element in the cited combination of references.

Further, Applicant agrees that Cook et al. neither teach nor suggest immersing a substrate in molten solder, as stated 1) at page 3, paragraph 5 the Office Action mailed March 31, 2000, and 2) in the "Response to Arguments" section at paragraph 1 of the Final Office Action mailed September 26, 2000 (which states that Cook does not show immersion as a deposition technique).

With regard to claims 1 and 9-10, at paragraph 3.a. the Office Action relies on Thomas, U.S. 4,661,374 for a teaching of deposition of solder by immersion, yet no portion of the Thomas reference is cited by the Examiner. Applicant respectfully notes that this makes Applicant's job difficult since Applicant must then search the entire Thomas document for the Examiner's asserted teaching. Applicant again respectfully requests that the Examiner indicate which elements of the present claims correspond to which reference number of drawings and/or passages in the text of any prior art cited if the rejections of the claims are maintained after review of the remarks below.

Again, without indication by the Examiner of the portions of the Thomas reference relied on, Applicant has attempted to parse through the Thomas document. Upon careful review thereof Applicant respectfully notes that Thomas teaches away from Applicant's invention as claimed. The combination including Thomas does not meet the invention as claimed.

Thomas states at col. 3, lines 63-66, “Besides eliminating the photomasking operations involved in vacuum evaporation and electroplating, *a solder reflow step is not required to spheridize the bumps 10–10. (emphasis added)*” Thomas teaches away from annealing as set forth in all of Applicant’s claims.

In addition, Thomas appears to teach successive immersion to increase the height of a solder bump, and is silent as to diameter of a via or the diameter of a solder bump. Thomas appears to refute the Examiner’s contention that “a via will inherently form a predetermined diameter, corresponding to the width/length of the via.” It is believed in light of the Examiner’s reliance on Thomas that its antithetical teachings must also be considered. Thomas clearly teaches away from a method of forming a solder ball contact including forming an exposed portion of a metal contact pad having a specific or predetermined diameter as set forth in all of Applicant’s claims.

Applicant respectfully maintains that neither Cook nor the cited combination thereof including Thomas, read on these elements of Applicant’s claims.

With regard to claims 13-23, at paragraph 3.b. of the Office Action, it is stated that Strube discloses the steps of electrolytically depositing solder on the exposed portion of the metal contact pad. However, the cited combination of references appears to teach away from electroplating. As pointed out hereinabove, Thomas states at col. 3, lines 63-66, “Besides *eliminating* the photomasking operations involved in vacuum evaporation and *electroplating*, a solder reflow step is not required to spheridize the bumps 10–10 (*emphasis added*)”. As the reference must be considered for its antithetical teachings, Applicant submits 1) one skilled in the art would not make the cited combination of Cook, Thomas and Strube; and 2) even if the combination were made, one skilled in the art would not find a teaching of electrolytic deposition of solder.

Applicant has amended independent claims 13, 15, 16 and 23 to clarify that the solder contact extends below the resist layer and below a surface of the insulating layer. Strube does not teach or suggest electrolytic deposition of solder on an exposed portion of the metal contact pad, the solder contact extending below the resist layer and below a surface of the insulating layer.

With regard to claims 8-12, 15, 20 and 23, at paragraph 3.c. of the Office Action, Official Notice is taken of "forming an exposed portion of the metal contact pad having a diameter specific diameter; wherein the insulating layer has a thickness of approximately 1.5 microns; and wherein the layer of lead and the layer of tin form a solder contact having a thickness of approximately 2.33 microns". Applicant requests under M.P.E.P. Section 2144.03 that the Examiner submit either an Affidavit under 37 C.F.R. Section 1.107(b) detailing the Examiner's knowledge of the prior art or showing where such contentions are supported, or that the rejection be withdrawn. Applicant's requests constitute a timely traversal of this assertion made by the Office Action.

New claims 68-75 are supported by the specification, claims and drawings as filed. Claims 68-70 depend from patentable base claims 1 and 13 and are likewise patentable. Claim 71 includes the limitation that the method consists essentially of the limitations recited in claim 1. New independent claims 72-75 respectively recite elements of independent claims 13, 15, 16 and 23 and further include the element of the solder contact extending below the resist layer and below a surface of the insulating layer.

Applicant considers additional elements and limitations of Applicant's claimed invention to further distinguish over the cited references, and Applicant reserves the right to present further arguments to this effect at a later date.

In view of the foregoing, Applicant respectfully submits that a prima facie case of obviousness is not made by Cook, Thomas and Strube. Withdrawal of the stated rejection and allowance of claims 1-24 and 64-67 and new claims 68-75 are respectfully requested.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney (612- 371-2148) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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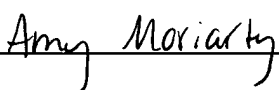
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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Commissioner of Patents, Washington, D.C. 20231, on this 27th day of June, 2001.

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